

**CALIFORNIA WATER PLAN
UPDATE 2013
GROUNDWATER CAUCUS
MAY 19, 2011**



WORKBOOK



NAME:

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**CALIFORNIA WATER PLAN, UPDATE 2013
GROUNDWATER CAUCUS MEETING
MAY 19, 2011, REGISTRATION 8:30
GENERAL SESSION 9:00 AM -12:30 PM**

Location: CalEPA Headquarters, Coastal Hearing Room
1001 I Street, Sacramento, CA 95814

Please RSVP to Chas Grant at: cgrant@water.ca.gov

A non-interactive Webcast of the session will be provided.

Webcast information will be posted here:

<http://www.calepa.ca.gov/broadcast>

Meeting Goals:

1. *Review planned groundwater deliverables.*
2. *Finalize Caucus Charge.*
3. *Seek policy/guidance input on groundwater deliverables*

AGENDA

#	TIME	ITEM	PRESENTERS
1.	8:30 AM	REGISTRATION	Department of Water Resources (DWR)
2.	9:00	WELCOME, AND INTRODUCTIONS Ground Rules And Logistics <ul style="list-style-type: none"> • Process for Group Membership 	Kamyar Guivetchi, DWR Lisa Beutler, Executive Facilitator, MWH
3.	9:20	WATER PLAN: WHERE WE HAVE BEEN AND WHERE WE ARE GOING <ul style="list-style-type: none"> • Overview of California Water Plan Update 2013 • Groundwater - a component of Integrated Water Planning 	Paul Massera, DWR
4.	9:40	PLANNED GROUNDWATER CONTENT ENHANCEMENTS FOR CALIFORNIA WATER PLAN UPDATE 2013 <ul style="list-style-type: none"> • Project background • Project deliverables Q&A	Abdul Khan & Dan McManus, DWR
5.	10:10	OVERVIEW OF RECENT GROUNDWATER RELATED POLICY PUBLICATIONS	Tim Parker, Parker Groundwater, Public Advisory Committee Caucus Representative & Groundwater Resources Association (GRA)
6.	10:25	GRA CONTEMPORARY GROUNDWATER ISSUES COUNCIL	Vicki Kretsinger, Luhdorff & Scalmanini, Consulting Engineers & GRA
7.	10:35	Break	

#	TIME	ITEM	PRESENTERS
8.	10:45	GROUNDWATER CAUCUS SCOPE OF WORK <ul style="list-style-type: none"> • Charge of Groundwater Caucus • Policy/Guidance Related Topics <i>Group Member Discussion</i>	Abdul Khan & Tim Parker Facilitator, All
9.	11:45	<i>Group Reports</i>	Facilitator, All
10.	12:05 PM	Public Comment (Please Advise Facilitator)	Public Participants
11.	12:15	Next Steps	Rich Juricich, DWR, Lisa Beutler (Facilitator)
12.	12:30	ADJOURN	Paul Massera, Kamyar Guivetchi

*If you need reasonable accommodations due to a disability,
please contact Karina Ortega 916-653-8036, TDD (916) 653-6934.*

Meeting Ground Rules

There will be many opportunities for meeting participants to engage group discussion. Participants are asked to subscribe to several key agreements to allow for productive outcomes

USE COMMON CONVERSATIONAL COURTESY

Don't interrupt; use appropriate language, no third party discussions, etc.

ALL IDEAS AND POINTS OF VIEW HAVE VALUE

During our initial meetings you may hear something you do not agree with or you think is "silly" or "wrong." Please remember that the purpose of the forum is to share ideas. All ideas have value in this setting. The goal is to achieve understanding. Simply listen, you do not have to agree, defend or advocate.

HONOR TIME

We have an ambitious agenda, in order to meet our goals it will be important to follow the time guidelines given by the facilitator.

HUMOR IS WELCOME

BUT humor should never be at someone else's expense.

BE COMFORTABLE

Please feel help yourself to refreshments or take personal breaks. If you have other needs please let a facilitator know.

OTHER?

SPELLING DOESN'T COUNT

Research indicates that writing on a vertical surface (like blackboards or flipcharts) actually increases the number of spelling errors.

ELECTRONICS COURTESY

Most of the participants have demanding responsibilities outside of the meeting room. We ask that these responsibilities be left at the door. Your attention is needed for the full meeting. Please turn cell phones, or any other communication item with an on/off switch to "silent." If you do not believe you will be able to participate fully, please discuss your situation with one of the facilitators.

USE THE MICROPHONE

We are in a large room with varying acoustics. Please use a microphone so that others can hear you.

AVOID EDITORIALS

It will be tempting to analyze the motives of others or offer editorial comments. Please talk about YOUR ideas and thoughts.



Working In Groups

You will spend most of the session working in groups. As a group you will be asked to analyze or develop ideas, keep track of the issues you develop then make a report to the larger group. Each group will need:

Facilitators/ Leaders: Facilitators will be available to work with most of the groups. In the event a facilitator is not available, one or more members should ensure that the group stays with the assigned task and that all participants have an opportunity to share ideas. This person and all group members should ensure use of the ground rules.



Recorder: Ideas will be shared on flipcharts. Information from the charts will be used to make reports AND used later to transcribe the proceedings of the meeting. Ask the facilitators if you need help with this. For each set of questions please:

- A. Put Table # and Page # on each sheet
- B. Note the issue being addressed
- C. Prepare Summary Sheet for the reporter

Reporter: Someone will report on behalf of the full group.

- Will summarize table conclusions from Flip Charts
- Should not be a Board member or staff
- Must speak into microphone
- Limit presentation to time allotted by Large Group Facilitator

Time Keeper: All activities will involve specific blocks of time. In order to complete tasks, one group member needs to keep track of time.

Personal Worksheets: In addition to the group notes, you may wish to make more in-depth individual or organizational comments. Extra workbooks will be available in each group to do this. These may also be turned in at the end of the session. If you are willing to include your name and contact information, it will help the person preparing the notes in the event they have questions.

Water Plan Standing Charter Language

All Water Plan advisory groups operate under similar basic ground rules and with the following basic charter guidelines. Please feel free to contact your facilitator or group leader if you have questions regarding the standing Charter Language.

EXECUTIVE SPONSOR

The Deputy Director responsible for production of the California Water Plan Update, within the Department of Water Resources, or his/her designee, serves as Executive Sponsor.

MEMBERSHIP

Members serve at the pleasure of the Executive Sponsor and may be added or removed as appropriate. The Executive Sponsor shall:

1. Seek to maintain a balance of perspectives in the group,
2. Have the ultimate responsibility for all appointments

Members serve as individuals and are expected to be proficient in the area of discussion and/or represent a specified community or constituency with a “stake” in California’s Water Plan.

ATTENDANCE

Members commit to maintaining the integrity of the group by attending meetings and will contact the Group Facilitator or Leader if unable to attend.

ROLES

Individual Members will:

- Act as a liaison to communicate information to and from their organization
- Act in a manner that will enhance trust among fellow members
- Contribute data/information to clarify issues and eliminate false assumptions

The Water Plan Team will:

- Provide staff support and, as needed, a professional Facilitator for the meetings

- Collect and organize data
- Draft text for group review
- Provide technical support to the effort
- Provide for the physical arrangements for the meeting
- Provide requested information

Facilitators will:

- Provide meeting and facilitation support to the effort
- Ensure the fairness and transparency of the process
- Provide process advice

Executive Sponsor will:

- Provide resources for the effort
- In consultation with other State Agencies, provide the policy perspective of the Administration
- Provide overall direction

MEETING SCHEDULE

Meetings will be convened as outlined in the specific Group Charge, on a regular basis and with notice provided in advance.

INTERNAL AND EXTERNAL COMMUNICATIONS

Minutes of meetings will be available to Members at a reasonable time frame after the meeting. Members are encouraged to provide briefings on Water Plan activities to their organizations.

The Executive Sponsor may also provide briefings on group activities to key Executive staff of the Resources Agency, other Agencies and the Governor's Office.

To maintain the most productive communications, Members are asked to adopt the following guidelines:

1. People will represent comments made in meetings as organizational or general group comments. Avoid personal references.
2. No specific point of view may be attributed as a statement or position of the group without an explicit agreement to do so.
3. Parties agree to act in Good Faith in all aspects of this consensus-seeking process and to communicate their interests. Offers made in frank conversations will not be used against

any party. This provision will not restrict the ability of Members to speak to the press or pursue legal strategies in the future.

4. Personal attacks or stereotyping will not be acceptable. Members will refrain from impugning the motivations or intentions of others.
5. Parties agree to not make commitments they do not intend to follow through with
6. Parties will act consistently in other forums where similar issues are being discussed, including the press.
7. Parties agree to make a concerted effort to provide requested information to other Members or explain the reason why they could not do so.

WITHDRAWAL

Any Member or the Facilitator may withdraw at any time. Those withdrawing will be asked to communicate the reasons for withdrawal. Those leaving are expected to maintain the integrity of the ground rules and the process.

DISCLOSURE

During the course of the Water Plan deliberations it is likely significant policy issues will be discussed.

It is recognized that Members are associated with operating organizations and groups and have an obligation to make management decisions and take actions necessary for the proper function of those organizations. A stakeholder group may engage in such decisions and actions individually, or as a member of a coalition along with other stakeholder or non-stakeholder groups. The Water Plan Process is a long-term effort and during the course of Plan Updates, it is understood that stakeholder groups or coalitions will take public positions to protect their immediate interests. It is understood these interests may conflict with what is or might be derived from the Water Plan negotiations at any given point in time. Public positions taken in this context will not be considered a lack of commitment to the long-term mission.

Members embarking on a course that may result in conflict with immediate Water Plan deliberations are asked to advise the Facilitators and/or Group Leaders of potential and pending activities. These may include significant financial or policy decisions, proposed legislation, and public position statements by the groups regarding issues under the scope of the Water Plan. It is asked that this be done at the earliest feasible opportunity and the member suggest the best method to provide disclosure to the full group should it involve issues under the purview of the group. Such prior disclosure is not intended to prevent a Member from proceeding but instead is intended as a method to keep the group informed.

DECISION MAKING PROCESS

The Water Plan is a consensus seeking process. Specific items moved forward as a group product will be considered by the full body. Members will be permitted to note their level of consensus as ranging from Unqualified Support, Strong Support, General Support, Qualified Support, to Fundamental Disagreement. An issue without a broad degree of support will not move forward as a group product. The level of support for various items will be recorded. If an item receives a level of Fundamental Disagreement, the group will be asked to continue working until it appears a resolution is not attainable, or move on to an area where more agreement is possible. At that time the Executive Sponsor will note the nature of the disagreement and make a determination as to the best way to proceed in the particular issue area.

It is understood that Members may not always be able to commit their agency/organization to a particular conclusion; however, Members will operate and represent their organizations in good faith and contribute the best available information. Members are not required to commit to a position on any item.

OTHER

The Charter describes the work of the group. Changes may be adopted at the concurrence of the Members and the Executive Sponsor.

California Water Plan Update 2013

May 19, 2011

Groundwater

Objective:

Expand information about statewide and regional groundwater conditions in California Water Plan Update 2013 to better inform groundwater management actions and policies through compilation and summarization of data and analysis.

Premise:

- ◆ Existing water laws and regulations are in place.
- ◆ Deliverables are based on the best existing and available data, information, and analyses.

Deliverables:

- ◆ Compile groundwater information.
- ◆ Summarize groundwater conditions and management activity.
- ◆ Identify data gaps.
- ◆ Estimate annual change in groundwater storage.
- ◆ Present Case Studies.
- ◆ Inventory and describe potential for conjunctive management of groundwater and other supplies.
- ◆ Inventory and describe potential for groundwater banking and integrated flood management.
- ◆ Develop preliminary sustainability indicators.

Schedule:

- | | |
|--------------------------------------------------------------|---------------|
| ◆ Revise Project Charter based on Public AC feedback: | Spring 2011. |
| ◆ Form Groundwater Caucus: | May 19, 2011. |
| ◆ Compile and summarize information, and identify data gaps: | Late 2011. |
| ◆ Conduct analysis and prepare draft document: | Spring 2012. |
| ◆ Refine analysis and document: | Spring 2013. |
| ◆ Finalize analysis and document: | Fall 2013. |

Contact Information: Email

Abdul Khan: akhan@water.ca.gov &
 Dan McManus: mcmanus@water.ca.gov

Project Charter (Version __4__)

Date: __5/19/2011__

Project Name: Groundwater Content Enhancement in California Water Plan Update 2013

Sponsor/Program Manager	Paul Massera
Project Manager	Abdul Khan

Project Objective Statement: *What must the project do? By When? Keep this statement to 25 words or less. Make it SMART (Specific, Measurable, Achievable, Relevant, and Time-based).*

Triple Constraint Trade-off

Expand information about statewide and regional groundwater conditions in California Water Plan Update 2013 to better inform groundwater management actions and policies.

Resources	S	Select a different flexibility letter for each constraint N= Not Flexible S= Somewhat Flexible M= Most Flexible
Schedule	N	
Scope	M	

Estimated Start Date:	7/1/2010	Estimated End Date:	9/30/2013
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Project Deliverables: *What is the project going to produce? Create a list of tangible products that will result from project.*

1. Compile, organize, and integrate California's groundwater data, information, and analysis from existing State, federal, regional, and local water resource planning activities.
2. Using existing information, provide summary narratives on the groundwater conditions, institutional frameworks, and management activities at the statewide and Regional Report level. Based on available data and information, furnish site specific examples of groundwater conditions and management activities at the planning area/groundwater basin level, including the identification of groundwater basins having quantity or quality problems.
3. Identify data gaps for the State's groundwater basins and provide recommendations for future data collection efforts, including funds required to implement existing unfunded data collection and reporting mandates.
4. Quantify, qualify, and report the spring-to-spring change in groundwater storage at the planning area or groundwater basin scale. Qualification of the change in storage information will be made on the basis of availability of data.
5. Case Studies: In groundwater basins having sufficient data and analysis, present Case Studies including groundwater budget from various regions of the state that demonstrate the benefits, as well as the challenges and opportunities, associated with the collection and application of groundwater data, and the integration of local and regional water management strategies. Case Studies are intended to highlight the successes and challenges of applying integrated water resource management strategies within various regions of the state.
6. Inventory and describe the potential for conjunctive management of groundwater and other supplies, including the examination of potential groundwater recharge options, and the potential for developing multi-

benefit projects that could help generate source water for groundwater storage projects.

7. Inventory and describe potential for groundwater banking and integrated flood management. The inventory will be at the planning area/groundwater basin scale, and based on availability of existing studies and data.
8. Develop preliminary sustainability indicators for both groundwater quantity and quality.

Strategic Fit: *What is the Strategic Initiative Identifier for this project?*

- Supports Water Supply and Balance Team of the Water Plan Update in their work.
- Supports California's Groundwater (Bulletin 118).
- Supports resource management strategies such as conjunctive management and groundwater storage; groundwater and aquifer remediation; recharge areas protection; flood risk management; and pollution prevention at the regional level.
- Develops and supports recommendations of the Water Plan Update.
- Provides linkages to regional reports of the Water Plan Update.

Customer: *Who are you doing the project for?*

Primary Customers:

- State Agencies:
 - DWR.
 - State Water Resources Control Board (State Board).
 - California Public Utilities Commission (CPUC).
 - California Department of Public Health (CDPH).
 - California Governor's Office.
- Local agencies and regional water planning & management entities and groups.
- Delta Stewardship Council (DSC).
- California Legislature.
- California Native American Tribes.
- Groundwater experts working on groundwater issues in the state.
- Association of California Water Agencies (ACWA).
- Groundwater Resources Association of California (GRA).

Other Stakeholders:

- Water Plan Public Advisory Committee (PAC).
- State Water Analysis Network (SWAN).
- Water Plan State Agency Steering Committee.
- Federal Agencies.
 - U. S. Geological Survey (USGS).
 - U.S. Bureau of Reclamation (Reclamation).
 - U.S. Army Corps of Engineers (USACE).
- General public and individual groundwater users.

Customer Benefits: *What customer requirements does this project address? Relate these to: increase revenue, avoid costs, improve service, and/ or comply with a mandate? Create a short list of customer benefits.*

- Provides access to consolidated groundwater information from various State, federal, regional, and local water resource planning initiatives in a single document.
- Furnishes the status of regional groundwater conditions, management activities, and problem areas to help identify data gaps to better inform future groundwater monitoring needs and activities.

- Provides useful illustrations of local and regional management of groundwater resources through Case Studies.
- Helps improve groundwater management by providing access to existing information and data regarding groundwater resources; annual change in groundwater storage; inventory and identification of the potential for conjunctive management, groundwater banking and integrated flood management; groundwater quality, and sustainability.
- Highlights policy needs for the state's groundwater planning and management.

Successful Completion Criteria: *How will the success of the project be determined from the customer's perspective? Make criteria measurable so there is no doubt as to the project's success. Create a short list.*

- Number of groundwater basins for which annual change in groundwater storage information is developed.
- Number of water resource planning initiatives from which information has been integrated into the Water Plan.
- Number of water managers working with the Water Plan Work Team to help compile and develop the enhanced groundwater content.
- Number of comments received on the groundwater content.
- Positive survey response from members of the Water Plan Advisory Committee, Regional Forums, and Groundwater Caucus, associated with their participation and final deliverables of the Groundwater Content Enhancement effort.
- Number of entities outside the Water Plan using groundwater information generated by the Water Plan.
- Number of citations of the Water Plan groundwater component made in other studies within and outside DWR.

Project Background: *What is the primary motivation for this project? Include a brief high level description of the business area, the current situation, the desired situation, and the gaps that exist. This summary builds on your description in the Project Initiation form.*

As part of the Water Plan Updates 2005 and 2009 processes, Water Plan Advisory Committee members as well as other stakeholders highlighted the need to have access to better information about California's groundwater conditions. For example, the 1-2 million acre-feet of annual groundwater overdraft that is mentioned in both Updates 2005 and 2009 have raised questions for lack of rigorous technical analysis and associated documentation. Water Plan Update 2009, as Update 2005, provided limited quantitative information about groundwater resources in the Water Portfolios developed as part of the Updates. Changes in groundwater storage estimates in Update 2009 do not adequately characterize actual change in storage conditions because these estimates represent net groundwater uses for many areas of the state. As a result, there is a great need to improve our understanding, quantification, and reporting of groundwater resources in California. In areas that lack reliable data to analyze groundwater conditions, the goal to better manage the resource will likely remain unattainable. In the absence of data and analysis, also ineffectual will be the goal of effectively using conjunctive management of groundwater with other water supplies as part of Integrated Regional Water Management (IRWM) programs and projects.

The most current update of California's Groundwater (Bulletin 118, published in 2003) provided minimal quantitative information about California's groundwater conditions for the 10 different hydrologic regions of the state. Quantitative information was limited to basic well statistics, well yields, and supply well water quality. Because of resource and schedule constraints, there was no attempt to compile data adequately and conduct analysis to capture change in groundwater storage or furnish detailed groundwater budgets for any of the groundwater basins or DWR planning areas.

Another issue of concern is how to address long-term sustainability of groundwater from a quantity and a quality perspective. The major impediment, again, is lack of data and funding to undertake the appropriate analysis to assess sustainability of the resource through the development and on-going tracking of a set of relevant sustainability indicators.

Update 2013 will address the issue of lack of groundwater data with the vision of achieving a set of short-term goals, while identifying a broader set of long-term goals to be attained in future Water Plan Updates beyond 2013. The major short-term goals are: quantification of annual change in groundwater storage; identification of data gaps; integration of information among various State, federal, regional, and local planning initiatives; and Case Studies to illustrate utility of groundwater information for regional and local resource management. The most critical long-term goal is to develop detailed water budgets for groundwater basins/planning areas in the state.

Project Scope:

In Scope: <i>List areas and functionality included in project.</i>	Out of Scope: <i>List areas and functionality <u>not</u> included in project.</i>
<ul style="list-style-type: none"> • Integration of groundwater information from various State, federal, regional, and local planning activities; narratives on regional groundwater conditions and management activities; quantification of annual change in groundwater storage; and identification of data gaps. • Case Studies with detailed groundwater budgets for selected groundwater basins. • Inventory and identification of potential for conjunctive management, groundwater banking, and integrated flood management. • Preliminary sustainability indicators for groundwater quantity and quality. 	<ul style="list-style-type: none"> • Additional investigation or data collection. • Updated basin and subbasin groundwater budget type classification; and any new detailed groundwater budgets for planning areas, basins, or subbasins in the state. • Any new detailed analysis of groundwater quality conditions. • Any new detailed analysis of the rate and volume of groundwater extraction by planning area, basin, or subbasin. • Any new detailed evaluation of long-term decline in groundwater storage by planning area, basin, or subbasin. • Evaluation of subsidence potential of a planning area, basin, or subbasin. • An extensive analysis on sustainability indicators for groundwater quantity and quality.

Dependent Projects: *What projects must be underway or completed before this project can be successful?*

Dependent Projects:

- Water Plan Update 2013 Water Supply and Balance Team work, "Change in Groundwater Storage Component."
- California Statewide Groundwater Elevation Monitoring (CASGEM) program created by Groundwater Level Monitoring (SBx7-6).
- Statewide Integrated Flood Planning.
- DWR's California Central Valley Groundwater-Surface Water Model (C2VSIM).
- State Board's Groundwater Ambient Monitoring & Assessment (GAMA) Program.
- USGS Central Valley Hydrologic Model (CVHM), California's Central Valley Groundwater Study.
- Central Valley Regional Water Quality Control Board (CVRWQCB) Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS).
- Water Quality Control Plan for the Santa Ana River Basin; Water Quality Control Plan for the San Francisco Bay Basin; Water Quality Control Plan for the Central Coast Region; Water Quality Control Plan: Los Angeles Region; and Water Quality Control Plan for the San Diego Basin.

- DWR's Water Data Library (WDL).

Related Projects:

- Regional partnership program through IRWM (Prop 84, Prop 50).
- FloodSAFE Flood Management Initiative.
- Delta Plan.
- Bay Delta Conservation Plan (BDCP).
- Sacramento Valley Water Management Program (SVWMP).
- Water Transfers Program.
- Drought Program.

Risks: *What characteristics or situations could cause this project to fail? Identify those items which are outside the jurisdiction of project and could result in a "show-stopper" to the project success. Create a short list.*

- Limited data (the amount of information available is generally greatest in northern California and tends to be more limited to the south except the adjudicated basins in the south).
- Political sensitivity associated with the use of and access to groundwater data.
- Delays associated with data identification, acquisition, evaluation, analysis, and synthesis.
- The continued, focused coordination necessary to facilitate the work done by a large group of staff.
- Departure of key staff.
- Limitations in Water Plan funding that may prevent full project implementation.

Assumptions and Constraints: *What assumptions were made in defining project? Are there constraints to the execution of project? List assumptions and constraints.*

Assumptions:

- Existing water laws and regulations are in place.
- Project deliverables are based on the best existing and available data, information, and analyses.
- Water Plan Program Manager views this project as a high priority.
- Water Plan funding is available to dedicate staff in the Headquarter and the Regional Offices to work on the project.
- Staff in the Headquarter and the Regional Offices is available to work on the project on a priority basis for duration of Water Plan Update 2013.
- No turnover in key staff.

Constraints:

- Concurrent demands on the times of key staff by other projects.

This Project Should Have:

Project Management Plan <input type="checkbox"/>	PMP will include: <i>check all that apply</i>	Work Breakdown Structure <input type="checkbox"/>	Communications Plan <input type="checkbox"/>	Procurement Plan <input type="checkbox"/>	Human Resources Plan <input type="checkbox"/>
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Quality Management Plan <input type="checkbox"/>	Stakeholder Register <input type="checkbox"/>	Risk Register <input type="checkbox"/>	Project Budget <input type="checkbox"/>	Project Schedule <input type="checkbox"/>	DWR Form 1498 <input type="checkbox"/>
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Major High-Level Milestone Targets: *What events measure progress? E.g. Initiation Approved, Analysis Complete.*

Milestone	Target Date
Project objectives, deliverables, and resources needs; roles and responsibilities charts to integrate groundwater information from various State and federal initiatives; and roles and responsibilities charts for project deliverables.	12/2010
Project scope with detailed task breakdown, resources needs, and schedule.	02/2011
Project charter revised as per Public AC feedback and formation of Groundwater Caucus	05/2011
Compilation & integration of groundwater information from various State, federal, regional, and local planning initiatives.	12/2011
Narrative documents of groundwater conditions and management activities in each Regional Report.	12/2011
Documentation of data gaps for the State's groundwater basins.	12/2011
Draft documentation of groundwater data and analysis.	04/2012
Quantification and report on change in groundwater storage for planning areas/groundwater basins.	09/2012
Case Studies including detailed groundwater budget for selected groundwater basins.	03/2013
Inventory and identification of potential for a) conjunctive management of groundwater and other supplies, and b) groundwater banking and integrated flood management.	03/2013
Preliminary sustainability indicators for groundwater quantity and quality.	03/2013
Public Review draft of groundwater data and analysis.	04/2013
Final documentation of groundwater data and analysis for Water Plan Update 2013.	09/2013

Project Core Team Members

Team Member	Phone/E-mail	Role
Abdul Khan		Project manager
Dan McManus		Co-lead
DWR Northern Regional Office staff		Technical support
DWR North Central Regional Office staff		Technical support
DWR Southern Regional Office staff		Technical support
DWR South Central Reg. Office staff		Technical support
DWR Headquarter Office staff		Technical support
DWR Bay-Delta Office staff		Technical support
Other State Agencies' staff		Coordination

Charter Version Number: 4	
Updated By:	Date:



Approved By:	Date:
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Funding Information

Project Budget:	\$ TBD
Fund Center Title	TBD
Fund Center Number	TBD
Organization	DWR, California Water Plan
Contact Person	Lew Moeller
Phone/E-mail	

California Water Plan Groundwater Caucus GROUP CHARTER

Section 1 – Mission, Activities, Importance, Methodology

Group Charge:

The California Water Plan (CWP) Groundwater Caucus is a statewide topic-based workgroup designed to support development of *CWP Update 2013* through in-depth discussions and deliberations of core groundwater topics and issues. The Groundwater Caucus will help expand information associated with statewide and regional groundwater conditions and policy issues in California. The expanded statewide and regional information will help inform local groundwater management planning, actions, and policies, and help create a more fully developed and technically supported set of groundwater related recommendations for *CWP Update 2013*. Building on *CWP Update 2009*, the Groundwater Caucus will provide informational updates to technical project teams, Public and Tribal Advisory Committees, and the State Agency Steering Committee.

Parameters:

- The group will work within the context of existing water laws and regulations. While limitations and trade-offs to the current situation may be discussed, it will not be the focus of the deliberations.
- Project deliverables for *CWP Update 2013* will be based on the best existing and available data, information, and analyses from state, regional and local efforts and

planning activities.

Activities:

Content for the groundwater content enhancement portion of *CWP Update 2013* is being provided by DWR technical work teams, Public and Tribal Advisory Committees, the State Agency Steering Committee, Regional Forum participants, IRWM groups, and Groundwater Caucus members. The table below outlines the technical scope of DWR Groundwater Content Enhancement Initiative deliverables and the Caucus team focus. The Work Team develops technical content, and the Caucus team reviews and provides input to the technical content, reviews approach, and makes policy recommendations.

Scope:

Deliverables	Caucus Focus
<ul style="list-style-type: none"> • Compile groundwater information • Summarize groundwater conditions and management activities. 	<ul style="list-style-type: none"> • Provide input as appropriate on application and presentation of data, and methodologies.

Deliverables	Caucus Focus
<ul style="list-style-type: none"> • Identify data gaps and provide recommendations for future data needs and collection and analysis efforts. • Estimate change in groundwater storage for sufficiently characterized basins; provide recommendations for basins where further data characterization is required before such calculation is appropriate. 	<ul style="list-style-type: none"> • Provide input as appropriate on application and presentation of data, and methodologies
<ul style="list-style-type: none"> • Present Case Studies based on available information including key aspects of basin/regional groundwater characterization and conditions, water resources planning and data collection efforts, and implementation of effective management strategies. 	<ul style="list-style-type: none"> • Review list of case studies planned for inclusion in <i>CWP Update 2013</i>; review case study approach and make recommendations on potential options.
<ul style="list-style-type: none"> • Inventory and describe potential for conjunctive management of groundwater and other supplies. • Inventory and describe potential for groundwater banking and integrated flood management. • Develop sustainability indicators. 	<ul style="list-style-type: none"> • Evaluate policy considerations and make recommendations as appropriate. • Provide input as appropriate on planned objectives, guidelines, and/or approach.

For More information about the Group Activities, please contact

Team Leads

Abdul Khan, DWR: akh@water.ca.gov

Dan McManus, DWR: mcmanus@water.ca.gov

NOTE – ALL Water Plan Groups operate with the same standard ground rules and related charter language. For more information contact the group facilitator at: Lisa.Beutler@us.mwhglobal.com.

California Water Plan Update 2013 Groundwater Caucus

May 19, 2011

Deliverable 1: Compile groundwater information

We are compiling groundwater related information from existing State, Federal, and Local planning activities. These include:

- Groundwater management plans,
- CASGEM monitoring plans,
- IRWM plans,
- Local planning studies,
- Tribal Groups planning studies,
- Urban water management plans,
- Agricultural water management plans,
- Water transfer related data and information, and
- Groundwater modeling reports.

On request, a list of currently compiled information can be provided to the Caucus members.

Topics for Discussion

Policy/Guidance Related:

1. What other information related to groundwater data and management would you like to see considered and compiled?
2. What in your view are some of the options to organize and disseminate the compiled information?

Informational:

1. Can you provide contact information (name, organization, email, and telephone number) of persons who may be able to facilitate the Work Team's compilation of information planned for the deliverable as listed above?
2. To the best of your knowledge, what other information related to groundwater data and management are available and what is the contact information (name, organization, email, and telephone number) of persons who can provide that information to the Work Team?

NOTES

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Deliverable 1: Compile groundwater information

Question 2: What in your view are some of the options to organize and disseminate the compiled information?

Proposed Option: The proposed option is to organize and disseminate the data by region, then by data type. Organizing by region then type will allow for easier regional management of multiple aspects of the resource.

If we present by region then type, should we organize groundwater information Hydrologic Region, then by IRWM Group?

Potential Benefits:

- Most IRWM groups do not cross HR boundaries...(not true for South Coast).
- Data is presented in a way that is easily useable by IRWM groups.

Potential Drawbacks:

Data is not as usable for analyzing at the County or GW Basin level.

Example:

HYDROLOGIC REGION

1.1. IRWM RWMG 1.

1.1.1. GWMPs

1.1.1.1. Entity 1: Plan Highlights

1.1.1.2. Entity 2: Plan Highlights

1.1.2. UWMPs

1.1.2.1. Entity 1: Plan Highlights

1.1.2.2. Entity 2: Plan Highlights

1.1.3. AWMPs

1.1.3.1. Entity 1: Plan Highlights

How important is it to also have a summary of the groundwater information by data type, or aquifer type (alluvial vs fractured rock) to allow for more focused examination of the importance of this particular aspect of groundwater. An example would be to have a summary of groundwater recharge or conjunctive use potential at the Hydrologic Region scale, prior to providing information about recharge at the IRWM group scale.

Compiling Information: We can create summary tables to reflect the written breakdown of information, but they will likely need to be broken into a series of tables to meaningfully present the data.

IRWM Region & Group	GWMP	UWMP	AWMP	CASGEM
N. Sac Valley				
City A		x		x
City B		x		
RCD A				x
County A	x			x
County B	x			
Water District A	x		x	x
Water District B	x		x	
Upper Pit River				
City A		x		x
City B		x		

California Water Plan Update 2013 Groundwater Caucus

May 19, 2011

Deliverable 2: Summarize groundwater conditions and management activity

We are trying to provide summary information on the following:

- Brief physical description of aquifer systems, building on Bulletin 118-2003.
- General overview and status of regional aquifer conditions:
 - Report existing regional groundwater budget numbers (by County, basin, ?) when available.
 - Identify and develop key local (County, basin, ?) groundwater hydrographs.
 - Develop regional dot maps for dry versus normal year.
 - Describe aquifer historic response to normal vs. dry year demand.
 - Provide overview of existing groundwater problems (quantity, quality – salinization and/or salinity intrusion, and subsidence.)
- General overview and status of groundwater management activities: Groundwater management plans, groundwater ordinances, groundwater level monitoring programs, groundwater quality monitoring programs, subsidence monitoring programs, active recharge projects, activity in drought water bank programs, etc.

Topics for Discussion

Policy/Guidance Related:

1. What in your view are some of the options to organize, synthesize, and report the groundwater content developed?

Topics for Future Caucus:

2. What other content related to groundwater would you like to see developed going forward in the next Water Plan Update (2018)?

Informational:

1. Are you or your staff willing to participate in developing the groundwater content? Please provide contact information (name, organization, email, and telephone number).
2. Can you recommend local, regional, State, and federal agencies resource persons who may be willing to participate in developing the groundwater content? What is the contact information (name, organization, email, and telephone number)?

NOTES

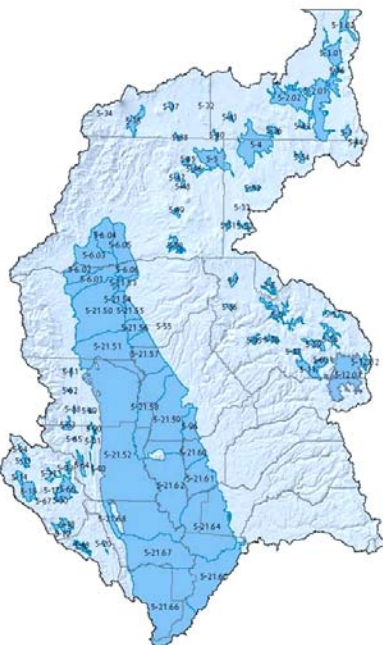
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Deliverable 2: Summarize groundwater conditions and management activity

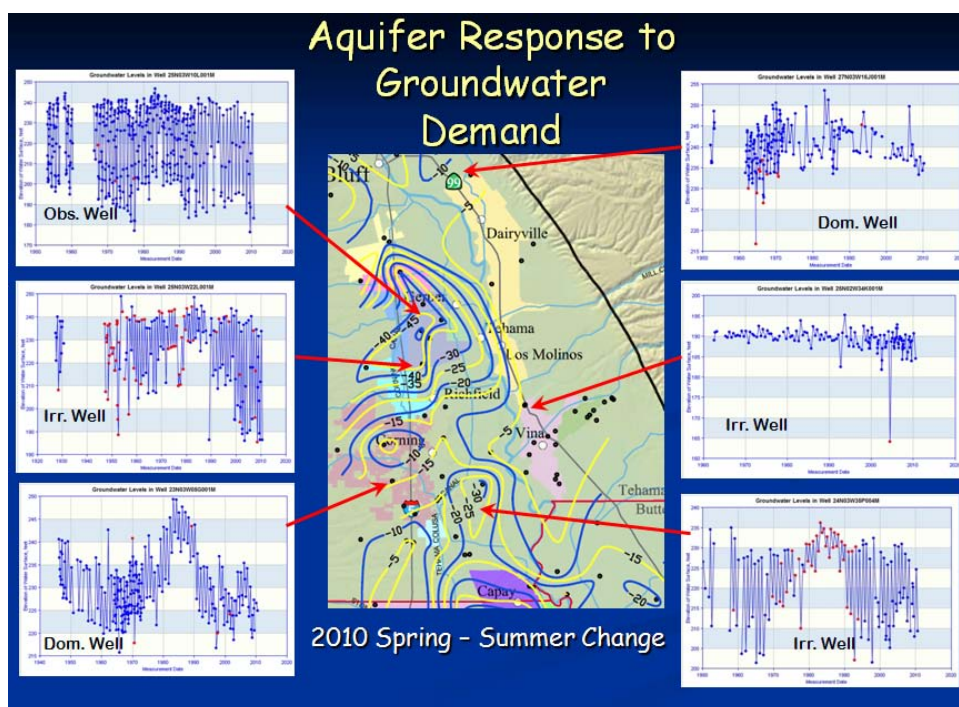
Question 1: What in your view are some of the options to organize, synthesize, and report the groundwater content developed?

Potential Options:

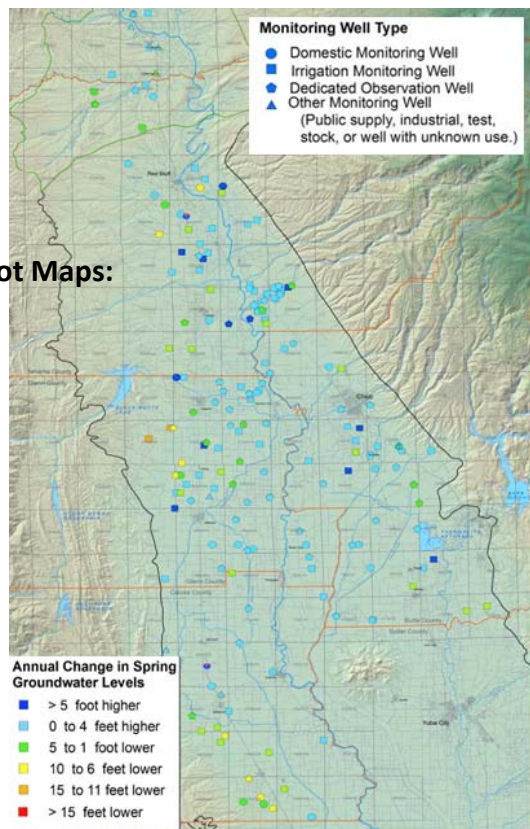
By Aquifer Types?



Graphic Options:
Hydrographs:



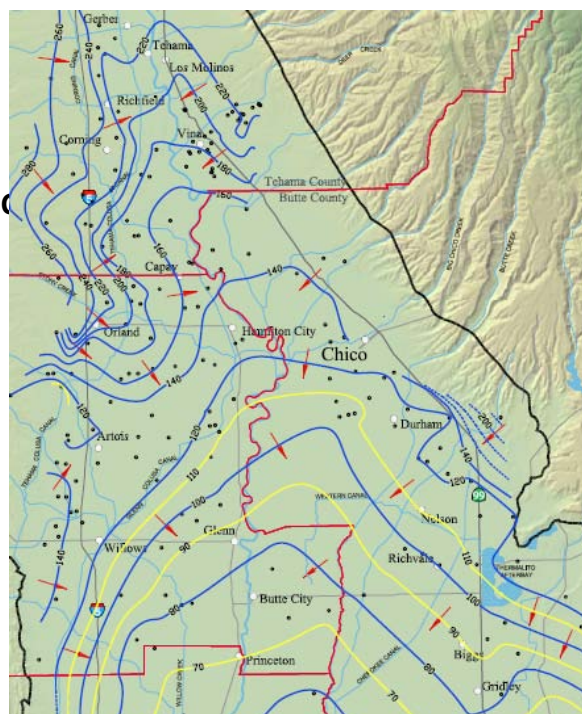
Dot Maps:



Summary Table:

DEPARTMENT OF WATER RESOURCES					
SPRING GROUNDWATER ELEVATION MEASUREMENTS					
NORTHERN SACRAMENTO VALLEY & REDDING BASINS, CALIFORNIA					
CHANGE IN GROUNDWATER ELEVATION BY WELL DEPTH					
SPRING 2009 to SPRING 2010					
	All Well Depths	Well Depth			
		0 to 200 ft-bgs	200 to 600 ft-bgs	600 to 1,380 ft-bgs	Unknown
BUTTE					
Maximum Increase in GWE* (ft)	8.6	6.1	8.6	4.6	2.8
Maximum Decrease in GWE (ft)	-6.2	-6.2	-3.2	-5.9	0.0
Average GWL Change (ft)	0.5	0.2	0.6	0.9	1.7
Range of GWL Change (ft)	12.8	11.3	9.8	10.5	2.8
Number of Wells	108	46	41	18	3
COLUSA					
Maximum Increase in GWE* (ft)	3.1	3.1	2.4	1.5	0.4
Maximum Decrease in GWE (ft)	-10.0	-7.7	-8.6	-10.0	-4.9
Average GWL Change (ft)	-1.2	-0.2	-1.6	-2.1	-2.0
Range of GWL Change (ft)	13.1	10.6	11.0	11.5	5.3
Number of Wells	63	22	26	10	5
GLENN					
Maximum Increase in GWE* (ft)	7.7	4.3	7.7	5.3	3.6
Maximum Decrease in GWE (ft)	-25.6	-8.1	-12.2	-9.0	-25.6
Average GWL Change (ft)	-0.4	0.5	-0.1	-2.2	-3.6
Range of GWL Change (ft)	33.3	12.4	19.9	14.3	29.2
Number of Wells	154	80	59	26	9
TEHAMA					
Maximum Increase in GWE* (ft)	9.8	7.5	7.8	9.8	6.0
Maximum Decrease in GWE (ft)	-9.7	-2.4	-9.7	-3.5	-1.6
Average GWL Change (ft)	1.0	1.2	0.8	0.3	1.6
Range of GWL Change (ft)	19.5	9.9	17.5	13.3	7.6
Number of Wells	140	60	55	17	8
REDDING BASIN					
Maximum Increase in GWE* (ft)	6.3	3.7	6.3	2.9	
Maximum Decrease in GWE (ft)	-2.6	-1.3	-2.6	-0.6	
Average GWL Change (ft)	1.0	1.0	1.0	0.7	
Range of GWL Change (ft)	14.1	6.9	11.2	10.9	
Number of Wells	44	21	18	5	0
TOTAL					
Maximum Increase in GWE* (ft)	9.8	7.5	7.8	9.8	6.0
Maximum Decrease in GWE (ft)	-25.6	-8.1	-12.2	-10.0	-25.6
Average GWL Change (ft)	0.2	0.6	0.2	-0.7	-1.0
Range of GWL Change (ft)	35.4	15.6	20.0	19.8	31.6
Number of Wells	509	209	199	76	25

Note: A positive number indicates that groundwater levels were higher in March 2010 than in March 2009; a negative number indicates that groundwater levels were lower in March 2010 than in March 2009.
*GWE=Groundwater Elevation



California Water Plan Update 2013 Groundwater Caucus

May 19, 2011

Deliverable 3: Identify data gaps

We are trying to identify data gaps for the State's groundwater basins based on existing groundwater management strategies, and provide recommendations for future data needs and collection and analysis efforts:

- Groundwater level measurement gaps.
- Groundwater quality measurement gaps.
- Groundwater basin characterization gaps.
- Subsidence monitoring gaps.
- Groundwater analysis and assessment gaps.
- Groundwater management and institution gaps.
- Data gaps for conjunctive management related information.
- Data gaps for information on groundwater banking and integrated flood management.

Topics for Discussion

Policy/Guidance Related:

1. What in your view are some of the options to present the information related to data gaps?

Topics for Future Caucus:

2. Are there any other data gaps that you think are important to consider?

Informational:

1. To the best of your knowledge, are there any studies and information on data gaps for the various groundwater basins of California? What are the reference study names and the contact information (name, organization, email, and telephone number)?

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Deliverable 3: Identify data gaps

Question 1: What, in your view, are some of the options to present the information related to data gaps?

Potential Options: Regional maps showing data gap areas by type and need, or priority, for filling this gap. For example could show data gaps areas with different colors or shapes depending on type data gap, and vary the size of the shape depending on the basin priority or management need to fulfill data gap.

California Water Plan Update 2013 Groundwater Caucus

May 19, 2011

Deliverable 4: Estimate annual change in groundwater storage

We intend to estimate change in groundwater storage for sufficiently characterized basins; and provide recommendations for basins where further data characterization is required before such calculation is appropriate. Over the last several years, DWR has been developing GIS based methodologies to estimate basin wide or sub-basin wide change in annual groundwater storage based on DWR's Water Data Library. The method consists of reading the water level data from Water Level Library, computing the change in water level for the basin, and then using this information with aquifer geometry data and aquifer properties to estimate the change in storage. We are documenting these procedures in a Technical memorandum scheduled to be released by July 2011. We are anticipating that the fully automated procedure in a multi-user environment will be completed by December 2011. The objective of developing this procedure is to provide more reliable estimates of groundwater change in storage, and to enhance the repeatability and reliability of these estimates.

The developed procedure will be used to quantify and report 2006 - 2010 change in groundwater storage by planning area/groundwater basin and will involve the following:

- Compile annual spring groundwater level data from 2006 through 2010.
- Calculate annual spring-to-spring change in groundwater level from 2006-2010.
- Calculate annual spring-to-spring change in groundwater storage from 2006-2010.
- Describe and illustrate change in storage information.

Topics for Discussion

Policy/Guidance Related:

1. How would you like to see the change in groundwater storage information presented?
2. In addition to change in groundwater storage, what other information related to groundwater storage would you like to see developed?
3. Provide feedback on terms related to groundwater storage.

Informational:

1. To the best of your knowledge, are there any technical studies conducted and analytical methods developed for calculating change in groundwater storage computations? What are the reference study names and the contact information (name, organization, email, and telephone number)?
2. Are you or your staff willing to review the above mentioned Technical Memorandum documenting change in groundwater storage procedure and provide us feedback to improve the procedure? Please provide contact information (name, organization, email, and telephone number).
3. Can you recommend local, regional, State, and federal agencies resource persons who may be willing to review the above mentioned Technical Memorandum and provide us feedback to improve the procedure? What is the contact information (name, organization, email, and telephone number)?

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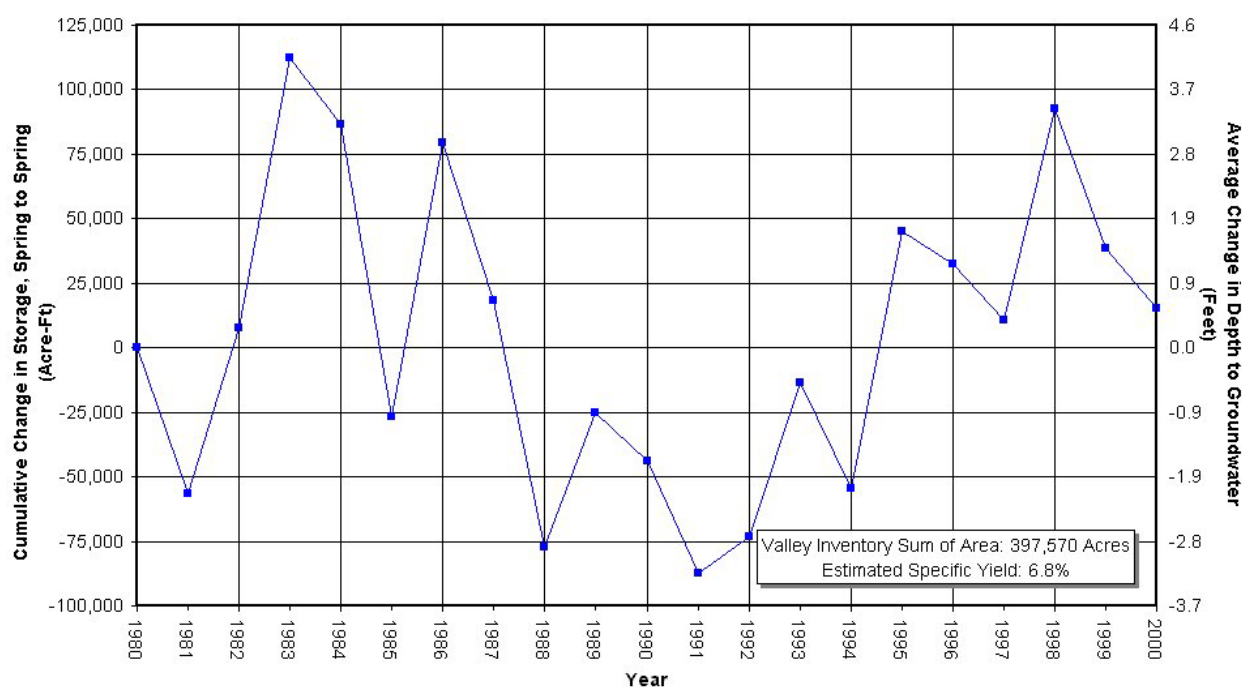
Deliverable 4: Estimate annual change in groundwater storage

Question 1: How would you like to see the change in groundwater storage information presented?

Potential Template Ideas:

We could show regional map with shapes of various sizes and colors to indicate spring-spring change in storage, or we could show a table summarizing the annual change by County, Planning Unit, or groundwater basin, or we could show a cumulative graphs similar to the one below.

Cumulative Change in Groundwater Storage Graphs by Basin



California Water Plan Update 2013 Groundwater Caucus

May 19, 2011

Deliverable 5: Present Case Studies

We intend to present Case Studies based on available information including key aspects of basin and regional groundwater characterizations and conditions, water resources planning and data collection efforts, and implementation of effective management strategies. In groundwater basins with sufficient data, existing analysis, and application of effective management strategies, we will present Case Studies including detailed groundwater budget that demonstrate the benefits associated with the collection and application of groundwater data, and the integration of local and regional water management strategies. The goal is also illustrate what resources management strategies are working, and most beneficial, within various regions of the state. We will review and consider using Case Studies presented in the recently published Groundwater Management Framework by ACWA and “Uncommon Innovation: Developments in Groundwater Management Planning in California” by Rebecca Nelson of Stanford University.

Topics for Discussion

Policy/Guidance Related:

1. What are some of the considerations you would like to see used for selecting illustrative Case Studies for Water Plan Update 2013? The Case Studies may be selected to highlight lessons learned and challenges overcome. The considerations for selecting Case Studies may include location, types of groundwater basins, extent of groundwater use, management strategies, innovative approaches to management, success in reversing groundwater depletion, and groundwater quality improvement.
2. Based on your knowledge and experience, what are some of the options to summarize and present the Case Studies to illustrate that data, information, and analysis are beneficial for implementation of water management strategies?

Informational:

1. Are you aware of any other studies/reports that include illustrative case studies? What are the reference study names and the contact information (name, organization, email, and telephone number)?
2. Are you aware of any local and regional studies/reports with sufficient data, detailed groundwater budget, and application of management strategies? What are the reference study names and the contact information (name, organization, email, and telephone number)?
3. Are you or your staff willing to participate in developing and fine tuning a set of criteria to select the Case Studies for including in Water Plan Update 2013? Please provide contact information (name, organization, email, and telephone number).
4. Can you recommend local, regional, State, and federal agencies resource persons who may be willing to participate in developing and fine tuning a set of criteria to select the Case Studies for including in Water Plan Update 2013? What is the contact information (name, organization, email, and telephone number)?

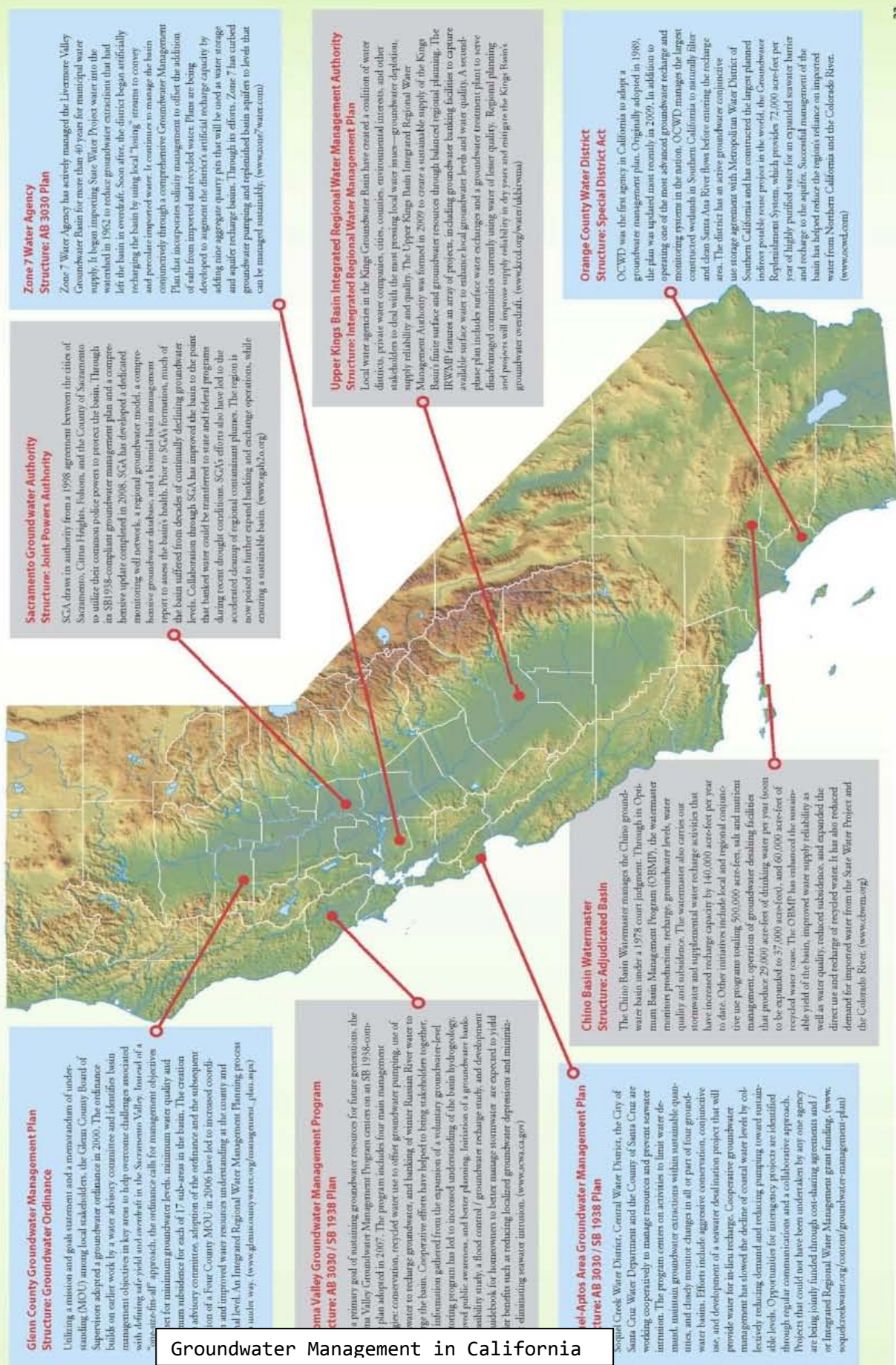
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Deliverable 5: Present Case Studies

Question 1: Based on your knowledge and experience, what are some of the options to summarize and present the Case Studies to illustrate that data, information, and analysis are beneficial for implementation of water management strategies?

Case Studies in Effective Local Groundwater Management in California



Potential Options:

Example 1: Use a series of narrative tables to organize and describe the various methods and approaches to meeting groundwater management criteria. The example below is from *Uncommon Approach*, by Rebecca Nelson.

4.2 Protecting connected surface waters

Californian law generally treats groundwater and surface water separately, though there are some exceptions to this (Hanak, et al., 2010, pp. 54-57). Some local agencies explicitly seek to ensure that groundwater pumping does not cause adverse impacts on surface waters, and implement corresponding measures (Table 11). These measures include studying the interaction between water bodies and reducing the effects of groundwater extraction on surface water.

Table 11: Methods of protecting connected surface waters

<i>Explicitly recognize a goal relating to surface water impacts of groundwater pumping, or vice versa</i>	<p>The Sonoma Valley GWMP includes as a Basin Management Objective (BMO) to "protect against adverse interactions between groundwater and surface water" in relation to Sonoma Creek, which provides habitat for fish and other wildlife and is a source of supply for agriculture, businesses and residences (Sonoma County Water Agency, 2007, pp. 3-4).</p> <p>The Olympic Valley GWMP includes BMOs to "[p]romote viable and healthy riparian and aquatic habitats by avoiding or minimizing future impacts from pumping on stream flows" and to "[s]upport ongoing stream restoration efforts as they relate to groundwater management" (HydroMetrics LLC, 2007, p. 70).</p> <p>The Western Canal Water District GWMP aims both to "[m]inimize changes to surface water flows and quality that directly affect groundwater levels or quality" and also to "[m]inimize the effect of groundwater pumping on surface water flows and quality" (Western Canal Water Dist., 2005, [1.2]), although the GWMP does not appear to include any measures directly specifically to these aims.</p>
<i>Study surface water-groundwater interaction</i>	<p>A component of the Soquel-Aptos area GWMP is to use stream gauges and shallow groundwater monitoring wells adjacent to and in Soquel Creek to investigate surface water-groundwater interactions (Soquel Creek Water Dist. & Cent. Water Dist., 2007, pp. 77, 83).</p> <p>The Olympic Valley GWMP includes as management measures participating in stream/aquifer interaction studies, and annually analyzing baseflow trends, shallow groundwater level trends, and "changes in apparent stream-aquifer interaction" (HydroMetrics LLC, 2007, p. 71).</p> <p>The Central Sacramento County GWMP provides for updating and using an integrated groundwater and surface water model (Sacramento County Water Agency, 2006, p. 3-22).</p>
<i>Include measures to reduce pumping impacts on surface waters</i>	<p>The Soquel-Aptos area GWMP documents a policy of the Soquel Creek Water Management District to use incentives (such as reduced connection fees) to encourage groundwater users with wells located near Soquel Creek to connect to the District's distribution system. The GWMP includes modifying pumping distribution based on annual analyses of data collected under the District's groundwater and</p>

Example 2: Use a more graphic approach with short descriptive summary. The example below is from ACWA's recently released *Sustainability for the Ground up, Groundwater Management in California*

California Water Plan Update 2013 Groundwater Caucus

May 19, 2011

Deliverable 6: Inventory and describe potential for conjunctive management of groundwater and other supplies

We intend to inventory and describe the potential and constraints for conjunctive management and multi-benefit projects:

- Identify the potential groundwater storage capacity (available aquifer space).
- Identify the availability of water for managed in-lieu or active recharge.
- Identify constraints: legal and institutional, infrastructure, water quality, environmental, general cost vs. benefit, etc.

Topics for Discussion (Future Caucus)

Policy/Guidance Related:

1. As part of this deliverable, what are some of the critical information you would like to see compiled?
2. What are some of the red flags you see that we need to be aware of as we develop this deliverable?
3. Based on your knowledge and experience and given the general sensitivity related to this issue and the significant prevailing institutional, regulatory, infrastructural, and other constraints, what in your view would be the most effective way to develop and present this deliverable?

Informational:

1. Are you aware of any studies/reports that have developed inventories of conjunctive management projects with project description, annual yield, cost, etc.? What are the reference study names and the contact information (name, organization, email, and telephone number)?
2. Are you or your staff willing to participate in developing the content for this deliverable? Please provide contact information (name, organization, email, and telephone number).
3. Can you recommend local, regional, State, and federal agencies resource persons who may be willing to participate in developing the content for this deliverable? What is the contact information (name, organization, email, and telephone number)?

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California Water Plan Update 2013 Groundwater Caucus

May 19, 2011

Deliverable 7: Inventory and describe potential for groundwater banking and integrated flood management

We intend to inventory and describe the potential and constraints for groundwater banking with integrated flood management (for the Central Valley, most of it will be from the CVFPP and Reservoir Reoperation Studies). For other Hydrologic Regions, most of it could from the Statewide Flood Management Plan):

- Evaluate local/regional opportunities to reduce runoff and increase recharge on residential, school, park, or other existing unpaved areas.
- Evaluate opportunities to enhance groundwater recharge by promoting/coordinating flood control activities that increase retention and recharge of peak storm flows and urban development projects.
- For Sacramento River Hydrologic Region, evaluate existing studies that assess the potential to increase agricultural and urban water supply, while promoting environmental processes, through reoperation of Oroville and Shasta Reservoirs.

Topics for Discussion (Future Caucus)

Policy/Guidance Related:

1. As part of this deliverable, what are some of the critical information you would like to see compiled?
2. What are some of the major constraints you see that we need to highlight when developing the content for this deliverable?
3. Based on your knowledge and experience, what would be the most effective way to develop and present this deliverable?

Informational:

1. Are you aware of any studies/reports that have developed inventories of projects integrating groundwater banking with flood management? What are the reference study names and the contact information (name, organization, email, and telephone number)?
2. Are you or your staff willing to participate in developing the content for this deliverable? Please provide contact information (name, organization, email, and telephone number).
3. Can you recommend local, regional, State, and federal agencies resource persons who may be willing to participate in developing the content for this deliverable? What is the contact information (name, organization, email, and telephone number)?

NOTES

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California Water Plan Update 2013 Groundwater Caucus

May 19, 2011

Deliverable 8: Develop preliminary sustainability indicators

We intend to develop preliminary sustainability indicators for both groundwater quantity and quality. This task will be done primarily as part of the California Water Sustainability Indicators effort started concurrently with the Groundwater Enhancement effort. The Groundwater Work Team and Caucus will participate and examine Hydrologic Region/Planning area based on developed indicators of sustainability.

Topics for Discussion (Future Caucus)

Policy/Guidance Related:

1. Based on your knowledge and experience, how would you define the sustainability of a groundwater basin?
2. Based on your knowledge and experience, what would you consider to be suitable indicators of groundwater sustainability for quantity and quality, considering all three aspects of sustainability – environmental, social, and economics? Do you see the need for different sets of indicators for different Hydrologic Regions and groundwater basins?
3. Based on your knowledge and experience, what in your view would be the most effective way to assess and report groundwater sustainability by Hydrologic Region and groundwater basin?

Informational:

1. Are you aware of any studies/reports that have developed indicators related to sustainable groundwater use and management? What are the reference study names and the contact information (name, organization, email, and telephone number)?
2. Are you or your staff willing to participate in developing the content for this deliverable? Please provide contact information (name, organization, email, and telephone number).
3. Can you recommend local, regional, State, and federal agencies resource persons who may be willing to participate in developing the content for this deliverable? What is the contact information (name, organization, email, and telephone number)?

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Terms Related to Groundwater Storage

Source: CA Bulletin 118, Update 2003
Chapter 6: Basic Groundwater Concepts

A number of terms are used to describe the existing or changing volume of groundwater in a basin. Some of these terms include groundwater storage capacity, usable groundwater storage capacity, available groundwater storage capacity, and change in groundwater storage. Similarities among the terms and variations in their common use often result in some confusion as to their exact meanings. The following section describes and illustrates several terms relating to groundwater basin storage. The groundwater storage definitions are adapted from Chapter 6 of *California Groundwater*, Bulletin, 118, Update 2003. Bulletin 118, Update 2003 can be obtained on line at: <http://www.water.ca.gov/groundwater/bulletin118/update2003.cfm>

Groundwater Storage Capacity:

Groundwater storage capacity describes the total groundwater storage capacity of a basin. “What is the groundwater storage capacity of an individual basin or within the entire State?” is one of the questions most frequently asked by private citizens, water resource planners, and politicians alike. Total storage capacity relates to how much physical space is available for storing groundwater. The computation of groundwater storage capacity is possible if data are available: capacity is determined by multiplying the total volume of a basin by the average specific yield (the percentage of groundwater that is actually available for extraction from the rock or sediments). The total storage capacity is constant and is dependent on the geometry and hydrogeologic characteristics of the aquifer (see Figure 1).

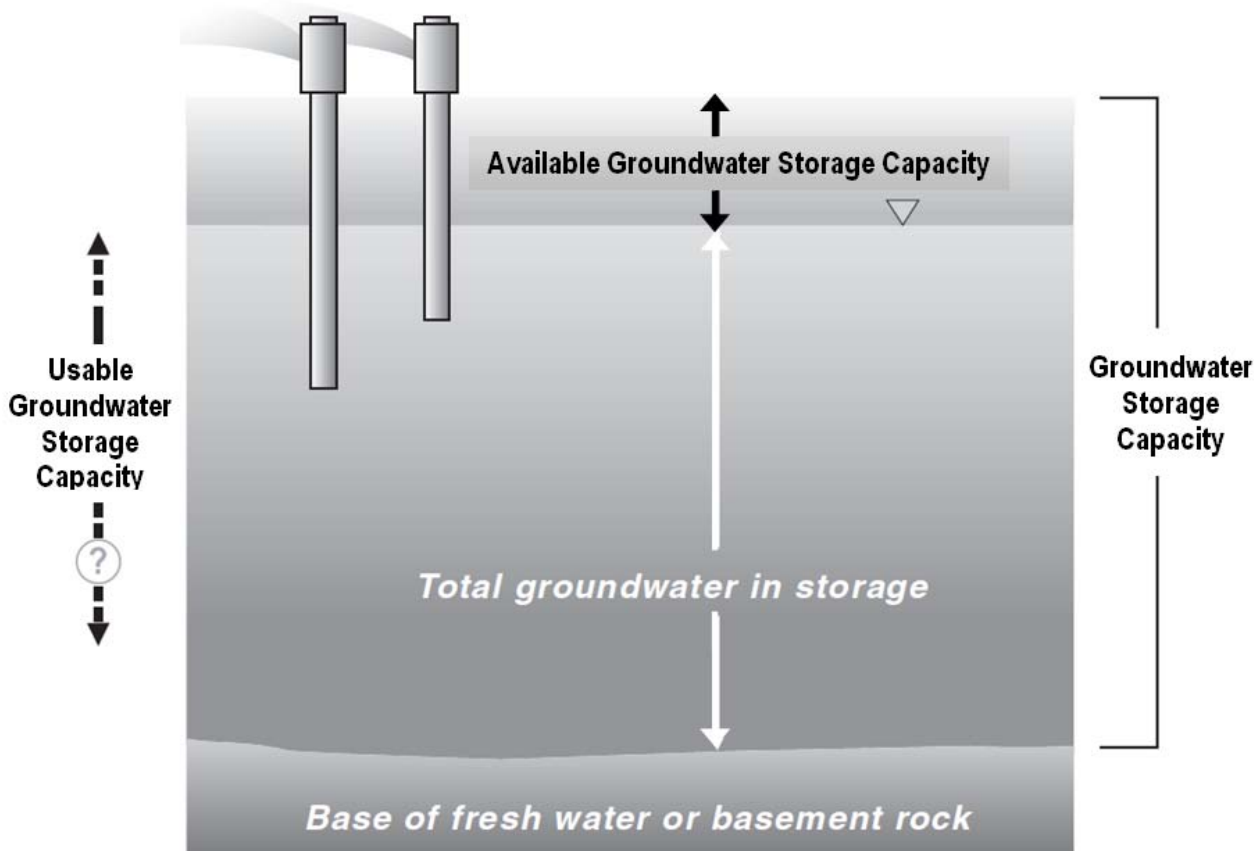


Figure 1. Schematic of total, usable, and available groundwater storage capacity

Groundwater storage capacity tends to be misleading because it only takes into account one aspect of the physical characteristics of the basin. Frequently, there are many other factors that ultimately limit the potential development of a groundwater basin. These include physical, chemical, economic, environmental, legal, and institutional factors. Difficulties in identifying and characterizing potential limitations to groundwater development make the utility of reporting total groundwater storage capacity somewhat questionable. Misleading or unqualified reporting of total groundwater storage capacity can lead to overly optimistic estimates of the useable groundwater storage capacity. The misleading reporting also does not clarify how much additional groundwater development can contribute to meeting future demands

Usable Groundwater Storage Capacity:

Usable groundwater storage capacity is defined as the amount of groundwater of suitable quality that can be economically withdrawn from storage. It is typically computed as the product of the volume of the basin to some basin specific depth that is considered economically available and the average specific yield of the basin (see Figure 1). Unfortunately, the term usable storage capacity is often used to indicate the amount of water that can be used from a basin as a source of long-term annual supply. However, the limitations associated with total groundwater storage capacity discussed above may also apply to usable storage. As a result, usable storage capacity is not necessarily static and it can change with long-term use.

Available Groundwater Storage Capacity:

Available groundwater storage capacity is defined as the volume of a basin that is unsaturated and capable of storing additional groundwater. It is typically computed as the product of the empty volume of the basin and the average specific yield of the unsaturated part of the basin (see Figure 1). The available storage capacity does not include the uppermost portion of the unsaturated zone in which saturation could cause problems such as crop root damage or increased liquefaction potential. The available groundwater storage capacity will vary depending on the amount of groundwater taken out of storage versus the amount of groundwater recharge. As the total groundwater in storage decreases, the available groundwater storage capacity increases.

Change in Groundwater Storage:

Change in groundwater storage describes the difference in groundwater volume between two time periods. Change in groundwater storage is calculated by multiplying the difference in groundwater elevation between two monitoring periods, by the area overlying the groundwater basin, and the average specific yield (or storativity in the case of a confined aquifer). The time interval over which the groundwater elevation change is determined is study specific, but annual spring-to-spring changes are commonly used due to increased aquifer stability during spring months.

Examining the spring-to-spring change in groundwater storage of a basin over a number of years is a relatively quick way to identify groundwater trends or aquifer response to changes in groundwater management over time. If change in storage is negligible over a period represented by average hydrologic and land use conditions, the basin may be considered to be in equilibrium under the existing demand and current management practices. Depending upon the availability of groundwater elevation data, change in groundwater storage estimates may be more frequently available than annual groundwater budget estimates. Although the calculation for change in groundwater storage appears to be relatively straight forward, in practice, the change in storage estimates can include many potential sources of error. Well construction data, groundwater level measurements, and physical

aquifer characteristics must be carefully evaluated before calculating change in storage. Mixing of wells constructed in confined and unconfined portions of the basin and mixing of measurements of different well sets over time may result in significant errors in calculating change in storage. However, when well measurement data are properly qualified and applied, change in groundwater storage can be a great tool for evaluating the annual and long-term physical response of the groundwater basin to changing hydrology, land use, and water resource management strategies.

CWP 2013 GROUNDWATER CAUCUS

Roster (as of May 18, 2011)

Staff

Team Leads

Abdul Khan, DWR: akhan@water.ca.gov
Dan McManus, DWR: mcmanus@water.ca.gov

Members

- Rich Juricich DWR
- Vern Knoop DWR
- Jose Alarcon DWR
- John Kirk DWR
- Mary Scruggs DWR

- Kelly Staton DWR
- Tanya Meeth DWR
- Brett Wyecof DWR
- Jack Tung DWR
- Mark Nordberg DWR

Current Public Membership List

Water Plan Public Advisory Committee Caucus Lead

Timothy K. Parker, Groundwater Resources Association of California

Members

1. Dr. Ali Taghavi, RMC-WRIME
2. Anton-Favorini-Csorba, Legislative Analyst Office
3. Ariel Dinar, UC Riverside
4. Barbara Hennigan, Butte-Sutter Basin Area Groundwater Users
5. Ben Rubin, Governor's Office of Planning and Research
6. Bill Mendelhall
7. Burt Wilson, Burt Wilson Co.
8. Chuck Jachens, Bureau of Indian Affairs -Pacific Region
9. Danielle Blacet, Association of CA Water Agencies
10. Danny Merkley, CA. Farm Bureau Assoc.
11. Dave Orth, King River Conservation District
12. David Bolland, Assn. Of CA. Water Agencies
13. David Cone, Kings River Rural Counties Conservation District
14. Eugene Massa Jr., Colusa Basin Drainage District
15. James Nachbaur, Legislative Analyst Office
16. Jane Wagner-Tyack
17. Jay Jasperse, Sonoma County Water Agency
18. Jennifer Svec, California Association of Realtors
19. Jobaid Kabir, USBR
20. Joe Zilles, Kleinfelder
21. Karen Buhr, Ca. Assn. Of RCDs
22. Karl Longley, California Water Institute-Fresno
23. Kathy Mannion, Regional Council of Rural Counties (PAC)
24. Laurel Marcus, Ca. Land Stewardship Institute
25. Lillian Kawasaki, Water Replenishment District of Southern California
26. Dr. Maurice Hall, The Nature Conservancy
27. Mike Wade, Ca. Farm Water Coalitions
28. Nick Konovaloff, Regional Council of Rural Counties
29. Rachel Ridgway, Hydrogeologist working on groundwater development (Design Team)
30. Reza Namvar
31. Rob Swartz, Sacramento Groundwater Authority
32. Rob Whittaker, Water Replenishment District
33. Dr. Saquib Najums, RMC-WRIME
34. Shannon Sweeney, City of Santa Maria, Utilities Dept.
35. Stathis Kostopoulous
36. Steve Haze, Sierra Resource Conservation District
37. Dr. Subhrendu Gangopadhyay, USBR
38. Tito Sasaki, Sasaki Vineyards (also Ca Farm Bureau Federation)
39. Troy Boone, County of Santa Cruz, EHS Drinking Water Program (PAC alternate)
40. Valerie Nera, CA. Chamber of Commerce
41. Vicki Kretsinger Grabert, Groundwater Resources Association of California (PAC)
42. Vickie Newlin, Butte County
43. Wendy Phillips, League of Women Voters of CA (PAC)
44. Yung-Hsin Sun, MWH Americas